In vivo Dielectric Response as Related to Tissue Structure, Function and Physiologic Activity in Selected Trees

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The dielectric properties of vegetation tissue are an integral component to the coupling of electromagnetic properties of a vegetation canopy and its physical properties. Understanding the dielectric behavior of vegetation is important (1) for establishing the connection to and allowing the interpretation of microwave remote sensing signatures of vegetated terrain and (2) as a tool to assist in monitoring and interpretation of the physiological processes within vegetation tissues.

In this paper, we present a series of *in vivo* dielectric measurements performed on several trees from selected zonobiomes under varying growth conditions and during various times of the growing season. Measurement series have been conducted with equipment designed to provide consistent and continuous *in situ* monitoring of the dielectric response of several woody vegetation components in a near simultaneous fashion. As vegetation species vary widely with respect to the structure and spatial distribution of hydroconductive tissues, we show that dielectric constant can be useful for characterization of the spatial distribution of phloem, xylem, and heartwood. Dielectric response to short-term and seasonal variations in hydrologic parameters are examined. We present a review of short term and seasonal dielectric response of trees influenced by a variety of growth conditions and meteorological parameters. Finally, we present an examination of temporal dielectric response as a function of position with single individuals.

The *in situ* data demonstrate that although a direct correlation between dielectric constant and the tissue hydroconductive structure may be inferred, the temporal response of dielectric constant is highly complex and time variant. Interpretation of the temporal behavior requires an understanding of the plant's hydrologic and chemical state. Understanding the physical processes that govern a plant's dielectric behavior may allow characterization of plant physiology from *in vivo* observation of vegetation dielectric constant.

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